

WHAT IS CLAIMED IS:

1. An alignment tool for positioning a cutting tool at a predetermined cutting location on a workpiece, the workpiece being affixed to a spindle of a shaping machine and being coaxially aligned therewith, the shaping machine being provided with at least orthogonal longitudinal and transverse cutting tool axes and orthogonal longitudinal and transverse shaping machine axes, said cutting tool axes and said shaping machine axes having independent orientation, each with respect to the other, the alignment tool comprising:

an arbor clamp for positioning a longitudinal center line of the alignment tool on an axis of rotation of the spindle;

an alignment tool body including:

an indicator surface longitudinally parallel to said longitudinal center line of the alignment tool; and

a plurality of cutting plane indicators coupled to said alignment tool body along said longitudinal center line of the alignment tool, each of said cutting plane indicators indicating a point on a corresponding one of a plurality of cutting planes, said point being located at a predetermined transverse distance from said longitudinal center line of the alignment tool,

wherein said point on one of said cutting planes coincides with the predetermined cutting location on the workpiece; and

cutting axis locator means coupled to said alignment tool body for aligning said longitudinal center line of the alignment tool to the longitudinal cutting tool axis, said cutting axis locator means including adjustment means for aligning said longitudinal center line of the alignment tool to the longitudinal cutting tool axis of the shaping machine independent of the orientation thereof to the longitudinal shaping machine axis, whereby the cutting tool located at the predetermined location on the workpiece may be translated parallel to the longitudinal cutting tool axis in said one of said cutting planes.

2. The alignment tool as recited in Claim 1, wherein each of said cutting plane indicators includes a protruding spur.

3. The alignment tool as recited in Claim 1, wherein each of said cutting plane indicators includes a knife edge.

4. The alignment tool as recited in Claim 1, wherein each of said cutting plane indicators includes an anvil.

5. The alignment tool as recited in Claim 1, wherein one of said cutting plane indicators is located on said longitudinal center line of the alignment tool.

6. The alignment tool as recited in Claim 1, wherein said cutting axis locator means includes low resolution indicator means and high resolution indicator means.

7. The alignment tool as recited in Claim 6, wherein said low resolution indicator means and said high resolution indicator means include, respectively, a low resolution spirit level vial and a high resolution spirit level vial.

8. The alignment tool as recited in Claim 7, wherein said low resolution spirit level vial and said high resolution spirit level vial are graduated by a plurality of division lines.

9. The alignment tool as recited in Claim 8, wherein each division line of said low resolution spirit level vial corresponds to a translation of a cutting plane indicator located on said longitudinal center line of the alignment tool of no more than 0.002 inches.

10. The alignment tool as recited in Claim 8, wherein each division line of said high resolution spirit level vial corresponds to a translation of a cutting plane indicator located on said longitudinal center line of the alignment tool of no more than 0.0002 inches.

11. The alignment tool as recited in Claim 6, wherein said adjustment means of said cutting axis locator means includes coarse and fine adjustment means.

12. The alignment tool as recited in Claim 11, wherein said coarse adjustment means rotates said low resolution and high resolution indicator means in a plane parallel to said alignment tool body and about an axis parallel to said axis of rotation of the spindle.

13. The alignment tool as recited in Claim 12, wherein said cutting axis locator means includes an upper section and a lower section, said upper section and said lower section immutably coupled at first corresponding edges thereof and held in spaced relationship at second corresponding edges thereof.

14. The alignment tool as recited in Claim 13, wherein said low resolution and high resolution indicator means are coupled to said upper section of said cutting axis locator means and said lower section of said cutting axis locator means is coupled to said alignment tool body.

15. The alignment tool as recited in Claim 14, wherein said fine adjustment means includes a fine adjustment screw for adjusting an amount of separation of said upper section of said cutting axis locator means with respect to said lower section of said cutting axis locator means at said second corresponding edges.

16. The alignment tool as recited in Claim 15, wherein a full rotation of said fine adjustment screw adjusts said amount of separation by no more than 0.006 inches.

17. The alignment tool as recited in Claim 1, further including a displaceable counterweight for positioning a longitudinal center of gravity of the alignment tool.

18. The alignment tool as recited in Claim 1, wherein said arbor clamp includes:

a V-shaped yoke inwardly disposed in said alignment tool body such that a vertex thereof is located on said longitudinal center line of the alignment tool; and

clamping means for positioning said longitudinal center line of the alignment tool on said axis of rotation of the spindle, said clamping means including a backing brace and a clamp screw, said backing brace being coupled to said alignment tool body so that a distal end of said clamp screw is directed towards said vertex of said V-shaped yoke.

19. The alignment tool as recited in Claim 18, wherein said distal end of said clamp screw includes a longitudinally displaceable tip, said displaceable tip biased by an elastic member toward said vertex of said V-shaped yoke.



20. An alignment tool for positioning a cutting tool at a predetermined cutting location on a workpiece, the workpiece being affixed to a spindle of a shaping machine and being coaxially aligned therewith, the shaping machine being provided with at least orthogonal longitudinal and transverse cutting tool axes and orthogonal longitudinal and transverse shaping machine axes, said cutting tool axes and said shaping machine axes having independent orientation, each with respect to the other, the alignment tool comprising:

- a displaceable counterweight for positioning a longitudinal center of gravity of the alignment tool;

- an alignment tool body including:

- a V-shaped yoke inwardly disposed therein such that a vertex thereof is located on a longitudinal center line of the alignment tool; and

- an indicator surface longitudinally parallel to said longitudinal center line of the alignment tool;

- a laser assembly coupled to said alignment tool body, said laser assembly having formed thereon a plurality of laser apertures disposed along said longitudinal center line of the alignment tool, each of said laser apertures emitting a laser spot for indicating a point on a corresponding one of a plurality

of cutting planes, said point being located a predetermined transverse distance from said longitudinal center line of the alignment tool, wherein said point on one of said cutting planes coincides with the predetermined cutting location on the workpiece;

clamping means for positioning said longitudinal center line of the alignment tool on an axis of rotation of the spindle, said clamping means including a backing brace and a clamp screw, wherein said backing brace is coupled to said alignment tool body so that a distal end of said clamp screw is directed towards said vertex of said V-shaped yoke; and

cutting axis locator means coupled to said alignment tool body for aligning said longitudinal center line of the alignment tool to the longitudinal cutting tool axis, said cutting axis locator means including adjustment means for aligning said longitudinal center line of the alignment tool to the longitudinal cutting tool axis of the shaping machine independent of the orientation thereof to the longitudinal shaping machine axis, whereby the cutting tool located at the predetermined location on the workpiece may be translated parallel to the longitudinal cutting tool axis in said one of said cutting planes.

21. An alignment tool for positioning a cutting tool at a predetermined cutting location on a workpiece, the workpiece being affixed to a spindle of a shaping machine and being coaxially aligned therewith, the shaping machine being provided with at least orthogonal longitudinal and transverse cutting tool axes and orthogonal longitudinal and transverse shaping machine axes, said cutting tool axes and said shaping machine axes having independent orientation, each with respect to the other, the alignment tool comprising:

a displaceable counterweight for positioning a longitudinal center of gravity of the alignment tool;

an alignment tool body including:

a V-shaped yoke inwardly disposed therein such that a vertex thereof is located on a longitudinal center line of the alignment tool; and

an indicator surface longitudinally parallel to said longitudinal center line of the alignment tool; and

a plurality of cutting plane indicators integrally coupled to said alignment tool body along said longitudinal center line of the alignment tool, each of said cutting plane apertures indicating a point on a corresponding one of a plurality of cutting planes, said point being located a predetermined

transverse distance from said longitudinal center line of the alignment tool, wherein said point on one of said cutting planes coincides with the predetermined cutting location on the workpiece;

clamping means for positioning said longitudinal center line of the alignment tool on an axis of rotation of the spindle, said clamping means including a backing brace and a clamp screw, wherein said backing brace is coupled to said alignment tool body so that a distal end of said clamp screw is directed towards said vertex of said V-shaped yoke; and

an electronic level coupled to said alignment tool body for aligning said longitudinal center line of the alignment tool to the longitudinal cutting tool axis, said electronic level coupled to controller means for storing a user-selected orientation in space of said electronic level, said orientation in space corresponding to said longitudinal center line of the alignment tool being parallel to said longitudinal cutting tool axis.